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Alcohol consumption and alcohol-attributable burden of disease in Switzerland, 2002

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Original article

Alcohol consumption and alcohol-attributable burden of disease in Switzerland, 2002

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Summary

Objectives: This analysis estimated alcohol-attributable burden of disease for Switzerland.
Methods: Exposure distributions were taken from the 2002 Swiss Health Survey and adjusted for per capita consumption. Risk relations were taken from meta-analyses. Mortality and burden of disease data were taken from the World Health Organization.
Results: Overall consumption and alcohol-attributable mortality and burden of disease in Switzerland were high compared to European and global averages, especially among women. Overall in Switzerland in 2002, 2016 deaths (5.2 % of all deaths in men, 1.4 % in women), 28,939 years of life lost (men: 10.5 %, women: 4.9 %) and 70,256 disability adjusted life years (men: 12.9 %, women: 4.2 %) were attributable to alcohol. These numbers are net numbers already incorporating the cardioprotective and other beneficial effects of alcohol.
Conclusions: Limitations of the approach used are discussed. In addition, questions of causality and confounding are addressed.

Key words. **Alcohol – Switzerland – Burden of disease – Mortality – Years of life lost – Disability adjusted life years (DALYs).**

Alcohol is one of the most important risk factors worldwide for global burden of disease, with 4.0 % of the total burden attributable to this exposure ((Ezzati et al. 2002; Ezzati et al. 2004; WHO, 2002; Lopez et al. 2006); for details on alcohol see (Rehm et al. 2003a; Rehm et al. 2003b; Rehm et al. 2004)). In Europe especially, alcohol consumption and attributable burden of disease is high compared to global averages. In 2002, adult per capita alcohol consumption was estimated to be 11.9 litres (l) pure alcohol in Europe, almost twice the global average of 6.21 (Rehm et al. 2006a). In terms of burden of disease, Europe was found to have alcohol-attributable deaths, years of life lost (YLL) and disability adjusted life years (DALYs) that were double or triple those estimated globally (Rehm et al. 2006a). Within Europe there are regional differences as well: patterns of drinking and burden of disease have a very definite West to East gradient, with less detrimental patterns of consumption (such as drinking in moderation and with meals) in Western Europe and more harmful patterns (such as heavy episodic drinking) in Central and Eastern Europe (Popova et al. 2007; Rehm et al. 2007a). As a result, an increasing gradient of alcohol-attributable disease was also seen for 2002, with rates of deaths, YLLs and DALYs increasing from West to East (Rehm et al. 2006a; Rehm et al. 2007a). In addition, there are regional patterns that are sex-specific (Makela et al. 2006).

In addition to regional trends in alcohol consumption and attributable disease, Europe is heterogeneous at the country level with respect to alcohol consumption and attributable harm. Likewise, the type of alcohol most widely consumed varies from country to country, with a particular increase in beer drinking and a corresponding decrease in wine and spirits consumption in the past decades (WHO Global Alcohol Database: http://www.who.int/globalatlas/default.asp). Thus, to develop policy recommendations, the World Health Organization (WHO) stressed the importance of efforts to monitor alcohol consumption at the country level and recommend corresponding alcohol policy that serve individual country needs (World Health Assembly 2005).

Table 1 Relative risks for alcohol-attributable diseases and injuries by consumption stratum (reference group is "current abstainers")

Disease condition	ICD-10	GBD code	Drinking category I RR	Drinking category II RR	Drinking category III RR	Sources and comments
Conditions arising during the perinatal period: Low birthweight	P05-P07	U050	M/W 1.00	M/W 1.40	M/W 1.40	(Gutjahr et al., 2001; Rehm et al., 2004)
Mouth and oropharynx cancers	C00-C14	U061	M/W 1.45	M/W 1.85	M/W 5.39	(Gutjahr et al., 2001)
Esophageal cancer	C15	U062	M/W 1.80	M/W 2.38	M/W 4.36	(Gutjahr et al., 2001)
Colon and rectal cancers	C18-C21	U064	M/W 1.00	M 1.16 W 1.01	M 1.41 W 1.41	(Cho et al., 2004)
Liver cancer	C22	U065	M/W 1.45	M/W 3.03	M/W 3.60	(Gutjahr et al., 2001)
Breast cancer	C50	U069	<45 yrs W 1.15 45+ yrs W 1.14	<45 yrs W 1.41 45+ yrs W 1.38	<45 yrs W 1.46 45+ yrs W 1.62	(Ridolfo & Stevenson, 2001)
Other neoplasms	D00-D48	U078	M/W 1.10	M/W 1.30	M/W 1.70	(Rehm et al., 2004)
Diabetes mellitus (A regions)	E10-E14	U079	M 0.99 W 0.92	M 0.57 W 0.87	M 0.73 W 1.13	(Gutjahr et al., 2001)
Diabetes mellitus (Non-A regions)	E10-E14	U079	M/W 1.00	M/W 1.0	M 1.00 W 1.13	(Gutjahr et al., 2001)
Alcohol use disorders	F10	U086	–	–	–	AF 100 %
Unipolar depressive disorders a	F32-F33	U082				(Rehm et al., 2004)
Epilepsy	G40, G41	U085	M 1.23 W 1.34	M 7.52 W 7.22	M 6.83 W 7.52	(Gutjahr et al., 2001)
Hypertensive heart disease	I10-I14	U106	M 1.33 W 1.15	M 2.04 W 1.53	M 2.91 W 2.19	(Corrao et al., 1999)
Ischaemic heart disease[a]	I20-I25	U107	M/W 0.82	M/W 0.83	M 1.00 W 1.12	(Corrao et al., 2000); (Rehm et al., 2004)
Haemorrhagic stroke (A regions)	I60-I62	U108	M 1.12 W 0.74	M 1.40 W 1.04	M 1.54 W 1.94	(Reynolds et al., 2003)
Haemorrhagic stroke (Non-A regions)	I60-I62	U108	M 1.12 W 1.00	M 1.40 W 1.04	M 1.54 W 1.94	(Reynolds et al., 2003)
Ischaemic stroke (A regions)	I63	U108	M 0.94 W 0.66	M 1.13 W 0.84	M 1.19 W 1.53	(Reynolds et al., 2003)
Ischaemic stroke (Non-A regions)	I63	U108	M/W 1.00	M 1.13 W 1.00	M 1.19 W 1.53	(Reynolds et al., 2003)
Cirrhosis of the liver [a]	K74	U117	M/W 1.26	M/W 9.54	M/W 13.0	(Rehm et al., 2004)
Road traffic accidents [a]	[b]	U150	For all injury categories (shaded areas), the approach assuming that consumption strata specific RRs are generalisable across countries was only used as a sensitivity analysis. The main analyses used region-specific alcohol-attributable fractions, based on both the level of consumption and drinking pattern (for derivation see Rehm et al., 2004).			(Rehm et al., 2004)
Poisonings [a]	X40-X49	U151				(Rehm et al., 2004)
Falls [a]	W00-W19	U152				(Rehm et al., 2004)
Drownings [a]	W65-W74	U154				(Rehm et al., 2004)
Other unintentional injuries [a]	Rest of V, W20-W64, W75-W99, X10-X39, X50-X59, Y40-Y86, Y88, Y89	U155				(Rehm et al., 2004)
Self-inflicted injuries [a]	X60-X84, Y870	U157				(Rehm et al., 2004)
Violence [a]	X85-Y09, Y871	U158				(Rehm et al., 2004)
Other intentional injuries [a]	Y35	U160				(Rehm et al., 2004)

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The aim of this project was to model the impact of alcohol on mortality, years of life lost and burden of disease for Switzerland in a way that is compatible with current effort of the WHO in alcohol monitoring and surveillance.

Methods

Data and estimation procedure for exposure

Exposure was based on the 2002 Swiss Health Survey (Bundesamt für Statistik 2004). This survey is the third telephone survey conducted by the Federal Office of Statistics in intervals of five years. Data were collected by a random sample (n = 19,706) of persons aged 15 and over, living in Switzerland. The response rate was 64 % at the household level. Field work was carried out between January and December 2002. However, as surveys underestimate the true consumption (Midanik 1982; Rehm 1998), results had to be adjusted (for a description of methodology see Rehm et al., in press). We used the adult per capita data from the WHO Global Alcohol Database (http://www.who.int/globalatlas/default.asp) as basis for this adjustment. According to this source, 13.2 l pure alcohol were consumed per capita in Switzerland in 2002 in the population 15 years and older: 12.2 l recorded, 1 l unrecorded. Unrecorded consumption in the WHO is estimated based on surveys, indirect estimation method or expert judgements (Rehm et al. 2007). The survey data accounted for 48 % of the per capita consumption.

The estimates for this study are based on a combination of both data sources, where the adult per capita consumption is taken as the best indicator of the overall level of consumption (Gmel & Rehm 2004), and survey information is taken as the best indicator for the distribution of consumption by sex and age. The exact methods are described elsewhere (Rehm et al. 2006a; Rehm et al. 2006b; 2007b).

Data indicating burden of disease

Mortality, years of life lost (YLLs) and disability-adjusted life-years (DALYs) were the main outcomes used in this analysis (see http://www.who.int/whosis/whostat2006YearsOfLifeLost.pdf). Mortality was measured by number of deaths, YLLs were calculated from the number of deaths multiplied by a standard residual life expectancy at the age at which death occurred (life expectancy at birth: 80 years for men and 82.5 years for women), and the DALYs calculation added YLLs with years of life lost due to living with a disability. Overall estimates by disease category, sex and age for mortality, YLLs and DALYs for the year 2002 for Switzerland were obtained at WHO Headquarters (Dr. C. Mathers). YLLs and DALYs were 3 % age-discounted and age-weighted to be comparable with the Global Burden of Disease (GBD) study (Mathers et al. 2003; for a general definition of concepts see Lopez et al. (2006)). Population data were obtained from United Nations population division (United Nations 2005). Age groups used were: 0–4 years, 5–14 years, 15–29 years, 30–44 years, 45–59 years, 60–69 years, and 70+ years.

Relating alcohol exposure to disease and injury outcomes

Alcohol consumption was found to be causally related to a number of diseases, both chronic and acute, as well as a number of injury categories. The disease categories were taken from the GBD study (for GBD categories: Mathers et al. 2001; for the relationship to alcohol: Rehm et al. 2003c; Rehm et al. 2004) and are listed in Table 1.

RR – relative risk

[a] AAFs are taken from CRA for non-A regions (based on pooled cross-sectional time-series analyses)

[b] V01-V04, V06, V09-V80, V87, V89, V99. If four-digit ICD-10 data are available, use: V01.1-V01.9, V02.1-V02.9, V03.1-V03.9, V04.1-V04.9, V06.1-V06.9, V09.2, V09.3, V10.4-V10.9, V11.4-V11.9, V12.3-V12.9, V13.3-V13.9, V14.3-V14.9, V15.4-V15.9, V16.4-V16.9, V17.4-V17.9, V18.4-V18.9, V19.4-V19.6, V20.3-V20.9, V21.3-V21.9, V22.3-V22.9, V23.3-V23.9, V24.3-V24.9, V25.3-V25.9, V26.3-V26.9, V27.3-V27.9, V28.3-V28.9, V29.4-V29.9, V30.4.V30.9, V31.4-V31.9, V32.4-V32.9, V33.4-V33.9, V34.4-V34.9, V35.4-V35.9, V36.4-V36.9, V37.4-V37.9, V38.4-V38.9, V39.4-V39.9, V40.4-V40.9, V41.4-V41.9, V42.4-V42.9, V43.4-V43.9, V44.4-V44.9, V45.4-V45.9, V46.4-V46.9, V47.4-V47.9, V48.4-V48.9, V49.4-V49.9, V50.4-V50.9, V51.4-V51.9, V52.4-V52.9, V53.4-V53.9, V54.4-V54.9, V55.4-V55.9, V56.4-V56.9, V57.4-V57.9, V58.4-V58.9, V59.4-V59.9, V60.4-V60.9, V61.4-V61.9, V62.4-V62.9, V63.4-V63.9, V64.4-V64.9, V65.4-V65.9, V66.4-V66.9, V67.4-V67.9, V68.4-V68.9, V69.4-V69.9, V70.4-V70.9, V71.4-V71.9, V72.4-V72.9, V73.4-V73.9, V74.4-V74.9, V75.4-V75.9, V76.4-V76.9, V77.4-V77.9, V78.4-V78.9, V79.4-V79.9, V80.3-V80.5, V81.1, V82.1, V83.0-V83.3, V84.0-V84.3, V85.0-V85.3, V86.0-V86.3, V87.0-V87.8, V89.2, V89.9, V99, Y850.

Drinking categories	Men	Women
Abstainer or very light drinker	0–<0.25 g/day	0–<0.25 g/day
Drinking category I	0.25–<40 g/day	0.25–<20 g/day
Drinking category II	40–<60 g/day	20–<40 g/day
Drinking category III	60+ g/day	40+ g/day

[a] The limits of these categories are stated in grams of pure alcohol per day. For reference, a bottle of table wine contains about 70 grams of ethanol; 0.25 g/day corresponds to somewhat less than one glass of wine per month.

To determine the beneficial and detrimental health conditions causally attributable to alcohol for inclusion in this study, the usual epidemiological criteria were used with specific emphasis on the following (Hill 1965; English et al. 1995; Rothman & Greenland 1998): consistency across several studies, established experimental biological evidence of mediating processes or at least strong physiological plausibility (biological mechanisms), strength of the association (effect size), and temporality (i. e., cause before effect).

The disease categories found to be causally related were also cross-validated against major reviews (for a summary: Rehm et al. 2003c). The final selection was the same as for the Comparative Risk Assessment study (CRA) 2000 (Rehm et al. 2004; WHO 2002) with one exception: colorectal cancer was added. In other words, all of the major review studies in the 1990s and the early 2000s concluded a causal relationship between alcohol and the respective disease or injury category selected for this study (Rehm et al. 2003c), except for colorectal cancer, where some of the evidence is newer (Boffetta et al. 2006; Cho et al. 2004). In 2007, the International Agency for Research on Cancer (Baan et al. 2007) established alcohol consumption to be carcinogenic for colorectal cancer, and thus the decision to include this type of cancer seems justified.

The same criteria were used for determining causality with respect to detrimental and beneficial effects. Care was taken to control for potential confounding, especially confounding by tobacco smoking. Thus, even though alcohol was consistently related to lung cancer, even after usual control for confounding, it was not included as alcohol-attributable, because up to now there is no convincing biological pathway, and because residual confounding by tobacco smoking cannot be excluded.

Risk relations

Table 1 gives an overview on relative risks (RR) for different diseases by drinking categories. For most chronic disease categories, alcohol-attributable fractions (AAFs) of disease were derived from combining the prevalence of exposure and relative risk estimates based on meta-analyses (Cho et al. 2004; Corrao et al. 2000; English et al. 1995; Gutjahr et al. 2001; Rehm et al. 2003c; Ridolfo & Stevenson 2001) using the following formula (Walter 1976; 1980):

$$AF = \frac{\sum_{i=0}^{k} P_i(RR_i - 1)}{\sum_{i=0}^{k} P_i(RR_i - 1) + 1}$$

Where

i: exposure category with baseline exposure or no exposure i = 0

RR(i): relative risk at exposure level i compared to no consumption

P(i): prevalence of the i^{th} category of exposure

AAFs, as derived from the formula above, can be interpreted as reflecting the proportion of disease that would disappear if there had been no alcohol consumption.

For depression and injuries, AAFs were taken from the CRA study (see Rehm et al. 2004, for a detailed description of underlying assumptions and calculations). All AAFs by sex and age are available from the first author upon request.

Results

Prevalence of exposure

Table 2 presents prevalence of alcohol consumption in Switzerland in 2002 as estimated by the Swiss Health Survey (weighted to reflect age- and sex-distribution of the Swiss population aged 15 and over) and adjusted for per capita consumption. In total, 15.4 % of all adult men and 34.0 % of all women in Switzerland in 2002 were abstinent.

Mortality

Deaths attributable to alcohol consumption in Switzerland and WHO sub region Europe A are shown in Table 3. Overall, 2432 men and 1033 women died because of alcohol consumption and, taking into consideration the beneficial effects, 1575 net deaths among men and 441 net deaths among women were attributed to alcohol consumption. In relative terms, alcohol consumption caused almost 4 times as many net deaths in men compared to women, respectively, which was expected given the higher consumption in men. Despite their differences in relative and absolute mortality, however, the top causes of death were the same for both men and women, with the top three being cancer (M: 33.7 % of all alcohol-attributable deaths, W: 39.5 %), cardiovascular diseases (M: 18.7 %, W: 17.7 %), and liver cirrhosis (M: 17.9 %, W: 18.4 %). In addition to causing death, alcohol also prevented death from cardiovascular diseases (mainly ischaemic heart disease) and diabetes mellitus. Cardiovascular mortality *prevented* totalled 649 for men and 544 for women, which was greater than all deaths *caused* by alcohol-attributable cardiovascular diseases for each sex in Switzerland. Overall in Switzerland, alcohol prevented roughly one-third of all deaths caused by alcohol in men and about half of all deaths caused in women.

Comparison with the rest of Western Europe as operationalized by the WHO Europe A region showed some similarities and differences. Among deaths caused by alcohol, Switzerland and Europe A were identical in the top three categories,

Int J Public Health 52 (2007) 383–392
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although the relative importance of alcohol-attributable liver cirrhosis was higher in Europe A, and cardiovascular diseases were relatively more important in Switzerland. Deaths prevented by alcohol, especially for cardiovascular diseases, showed some marked differences. In Europe A, the deaths prevented by alcohol totalled approximately half of all alcohol-attributable deaths for men and outnumbered deaths among women by a factor of 2, resulting in a net preventive effect of alcohol among women in Europe A. In Switzerland, however, there were approximately three times more deaths caused by alcohol than prevented among men, and twice as many among women, accounting for the opposite net effect seen in Swiss women compared to European women (1.4 % of all deaths versus –2.4 %) and the higher relative importance of alcohol as a cause of death in Swiss men compared to the rest of Europe A (5.2 % of all deaths versus 3.5 %).

Years of life lost

Alcohol-attributable YLLs in Switzerland and comparisons with the rest of Europe A are shown in Table 4. Among Swiss men and women, the top three causes of YLLs were cancer, liver cirrhosis, and unintentional injuries. The shift from cardiovascular diseases to unintentional injuries was due to the finding that acute outcomes such as injury categories were associated with younger aged cohorts compared to chronic disease categories more associated with older age groups. Similar trends with respect to YLLs caused and prevented by alcohol were also seen within Switzerland and in comparison to Europe A, with much higher relative YLLs prevented in Europe A among both men and women. This was especially true among women, where a net protective effect was seen in Europe A (-1.2 %) and a marked net detrimental effect was estimated for Switzerland (4.9 %).

Disability adjusted life years

DALYs attributable to alcohol consumption in Switzerland and Europe A are shown in Table 5. The most striking difference between DALYs and YLLs/deaths was the much higher relative importance of neuropsychiatric disorders with respect to DALYs, especially alcohol use disorders. In Switzerland (and Europe) this disease category accounted for roughly half of all alcohol-attributable DALYs among men (52.5 %) and women (42.1 %). This was due to the fact that alcohol use disorders are much less fatal and occur earlier in life than the more traditional chronic diseases such as heart disease and cancers. The fact that DALYs are a time-based measure becomes important here, i. e. the longer one lives with a disability, the higher the DALYs. In addition, alcohol use and other neuropsychiatric disorders are chronic relapsing diseases with multiple episodes over a lifetime, resulting in high

Table 2 Prevalence of drinking in Switzerland 2002 from Swiss Health Survey adjusted for per capita consumption

	Men							**Women**						
Age groups in years	15–29	30–44	45–59	60–69	70 plus	All adults	contribution in g/day	15–29	30–44	45–59	60–69	70 plus	All adults	contribution in g/day
Drinking categories														
Abstainers and very light drinkers	21.8 %	12.9 %	14.1 %	12.5 %	15.4 %	15.4 %	0.02	38.5 %	32.2 %	26.4 %	30.1 %	45.7 %	34.0 %	0.04
Drinking category I	29.5 %	31.2 %	27.6 %	25.2 %	27.0 %	28.8 %	5.76	28.7 %	30.7 %	30.7 %	24.0 %	22.2 %	28.2 %	2.82
Drinking category II	25.0 %	33.8 %	36.0 %	37.4 %	32.7 %	32.7 %	16.35	24.3 %	25.9 %	31.8 %	36.3 %	24.5 %	28.0 %	8.40
Drinking category III	23.7 %	22.0 %	22.4 %	24.9 %	24.9 %	23.1 %	17.33	8.6 %	11.1 %	11.1 %	9.7 %	7.7 %	9.9 %	5.43
Total	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %	39.46	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %	16.69

Table 3 Deaths attributable to alcohol consumption in Switzerland and WHO region Europe A[a] in 2002

	Switzerland				EUR A			
	no.		%		no.		%	
	M	W	M	W	M	W	M	W
Maternal and perinatal conditions (low birth weight)	0	0	0.0	0.0	34	25	0.0	0.0
Cancer	818	408	33.7	39.5	36,809	22,793	29.2	41.7
Diabetes mellitus	0	0	0.0	0.0	0	0	0.0	0.0
Neuropsychiatric disorders	243	113	10.0	11.0	12,912	3,953	10.2	7.2
Cardiovascular diseases	454	183	18.7	17.7	12,243	5,164	9.7	9.4
Cirrhosis of the liver	436	191	17.9	18.4	31,850	13,012	25.2	23.8
Unintentional injuries	318	90	13.1	8.7	25,594	7,840	20.3	14.3
Intentional injuries	162	48	6.7	4.7	6,824	1,898	5.4	3.5
Total detrimental effects attributable to alcohol	**2,432**	**1,033**	**100**	**100**	**126,267**	**54,685**	**100.0**	**100.0**
Diabetes mellitus	–207	–47	24.2	8.0	–3,290	–3,108	5.6	3.0
Cardiovascular diseases	–649	–544	75.8	92.0	–55,205	–99,691	94.4	97.0
Total beneficial effects attributable to alcohol	**–856**	**–591**	**100**	**100**	**–58,495**	**–102,799**	**100.0**	**100.0**
All alcohol-attributable deaths	1,575	441	100.0	100.0	67,772	–48,114	100.0	100.0
All deaths	30,345	30,574			1,950,201	1,969,721		
Percentage of all deaths attributable to alcohol	5.2 %	1.4 %			3.5 %	–2.4 %		

[a] The WHO region Europe A denotes the part of Europe with very low childhood and very low adult mortality. It comprises the following countries: Andorra, Austria, Belgium, Croatia, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Luxembourg, Malta, Monaco, Netherlands, Norway, Portugal, San Marino, Slovenia, Spain, Sweden, Switzerland, and United Kingdom.

disability over the life course (Leshner 1999; McLellan et al. 2000). The majority of the other DALYs caused by alcohol in Switzerland and Europe A consisted of cancer, liver cirrhosis, and unintentional injuries. The protective effect of alcohol was also diminished using DALYs as an outcome measure compared to mortality, accounting for roughly an eighth of DALYs caused in men and a quarter of life years caused in women in Switzerland. The diminished effect on DALYs is trivial, as alcohol use disorders were the main contributor to DALYs and alcohol cannot have a protective effect on alcohol use disorders.

In Europe A, this diminished effect was also seen, especially among men, where a ratio of about 8:1 was estimated. Among women, DALYs caused by alcohol outnumbered DALYs prevented by a ratio of about 4:3. Overall, the relative detrimental impact of alcohol was similar in Swiss and European men, but about 3 times greater in Swiss compared to European women.

Discussion

Overall, before we discuss the implications for prevention, we would like to point out some methodological caveats. First, for consistency purposes and lack of alternatives, we took the mortality, YLL and DALY data from the WHO database. Switzerland has not yet conducted a detailed burden of disease study, so these should be seen as approximations that will be updated when the Swiss data become available. Second, the relative risks were derived from meta-analyses and are assumed to be consistent across countries, mainly because they reflect biological mechanisms. This assumption is probably not problematic for Switzerland, as most studies included in the meta-analyses are from European or North American countries with similar genetic background and health care systems. However, the AAFs for injury may be more problematic, as the relationship between alcohol and injury has been shown to be influenced by culture and society

Int J Public Health 52 (2007) 383–392
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Table 4 YLLs attributable to alcohol consumption in Switzerland and WHO region Europe A[a] in 2002

	Switzerland				EUR A			
	no.		%		no.		%	
	M	W	M	W	M	W	M	W
Maternal and perinatal conditions (low birth weight)	9	3	0.0	0.0	1,114	829	0.1	0.1
Cancer	7,938	4,333	27.4	36.8	406,401	258,511	22.2	37.9
Diabetes mellitus	0	0	0.0	0.0	0	0	0.0	0.0
Neuropsychiatric disorders	3,059	1,472	10.6	12.5	199,884	60,077	10.9	8.8
Cardiovascular diseases	3,488	1,465	12.0	12.4	119,588	42,103	6.5	6.2
Cirrhosis of the liver	5,246	2,393	18.1	20.3	427,765	173,927	23.4	25.5
Unintentional injuries	5,967	1,212	20.6	10.3	528,526	108,532	28.9	15.9
Intentional injuries	3,270	911	11.3	7.7	144,790	37,458	7.9	5.5
Total detrimental effects attributable to alcohol	**28,978**	**11,789**	**100**	**100**	**1,828,068**	**681,438**	**100.0**	**100.0**
Diabetes mellitus	–1,694	–392	23.8	8.3	–37,538	–25,453	7.6	3.2
Cardiovascular diseases	–5,412	–4,329	76.2	91.7	–454,566	–777,957	92.4	96.8
Total beneficial effects attributable to alcohol	**–7,106**	**–4,721**	**100**	**100**	**–492,104**	**–803,410**	**100.0**	**100.0**
All alcohol-attributable YLLs	21,871	7,068	100.0	100.0	1,335,964	–121,972	100.0	100.0
All YLLs	207,539	144,394			14,133,339	9,830,315		
Percentage of all YLLs attributable to alcohol	10.5%	4.9%			9.5%	–1.2%		

[a] see Table 3 for further explanations.

to a large degree (Sethi et al. 2006). It is necessary that ongoing and future Swiss studies should be used to put the results of this study in perspective. Third, the estimates for the age group 70 years and older are certainly overestimates, both for beneficial and detrimental effects. Relative risks have been shown to decrease with age and, while there are quantifications of this effect for major tobacco-related risks, no quantification exists for alcohol-attributable diseases (see Rehm et al. (2006c) for references and further information). Fourth, there may be some confounding by smoking which has not been removed by the usual techniques for control. For some aero-digestive cancers particularly (such as laryngeal, pharyngeal), there are independent and joint effects of tobacco and alcohol (Taylor & Rehm 2006), so that a small percentage of these cancers may be overestimated in the current study based on those studies in the meta-analyses, which did not adequately control for these effects. Last, the procedure for adjustment of the survey data may overestimate consumption in heavy drinking categories if a key assumption for this procedure, i.e., that undercoverage is a result of missing certain heavy drinking populations such as the homeless and the institutionalized, is not valid (Gmel & Rehm 2004). Rehm et al. (2006c) give some sensitivity analyses for potential consequences for burden of disease if certain assumptions for adjusting survey data do or do not hold true.

The final point we would like to discuss concerns causality. As outlined above, we used the usual epidemiological criteria of causality (Hill 1965; Rothman & Greenland 1998). In using these criteria, we stressed especially the potential biological pathways, and no disease condition was included without such a pathway. In past years, there has been doubt concerning the beneficial effects of alcohol, especially the cardio-protective effect (Shaper 1990; Fillmore et al. 2006). Most of these claims have been made based on epidemiological reasoning, i.e. lack of or inadequate control for confounders. While there is certainly room for improving the

Table 5 DALYs attributable to alcohol consumption in Switzerland and WHO region Europe A[a] in 2002

	Switzerland				EUR A			
	no.		%		no.		%	
	M	W	M	W	M	W	M	W
Maternal and perinatal conditions (low birth weight)	19	10	0.0	0.0	1,755	1,419	0.0	0.1
Cancer	8,331	4,816	13.2	22.8	425,555	289,368	10.9	22.9
Diabetes mellitus	0	0	0.0	0.0	0	0	0.0	0.0
Neuropsychiatric disorders	33,271	8,886	52.8	42.1	2,008,786	509,204	51.2	40.3
Cardiovascular diseases	4,324	1,613	6.9	7.6	168,881	46,230	4.3	3.7
Cirrhosis of the liver	6,288	3,021	10.0	14.3	520,850	225,561	13.3	17.8
Unintentional injuries	7,420	1,791	11.8	8.5	643,717	152,646	16.4	12.1
Intentional injuries	3,416	976	5.4	4.6	151,130	39,953	3.9	3.2
Total detrimental effects attributable to alcohol	**63,070**	**21,113**	**100**	**100**	**3,920,674**	**1,264,381**	**100.0**	**100.0**
Diabetes mellitus	–2,929	–591	33.8	11.2	–104,457	–45,281	17.8	4.9
Cardiovascular diseases	–5,742	–4,666	66.2	88.8	–481,918	–875,145	82.2	95.1
Total beneficial effects attributable to alcohol	**–8,671**	**–5,257**	**100**	**100**	**–586,375**	**–920,426**	**100.0**	**100.0**
All alcohol-attributable DALYs	54,399	15,856	100.0	100.0	3,334,299	343,955	100.0	100.0
All DALYs	420,560	378,056			27,329,000	24,395,683		
Percentage of all DALYs attributable to alcohol	12.9%	4.2%			12.2%	1.4%		

[a] see Table 3 for further explanations.

quality of measurement in alcohol-epidemiological studies, particularly with respect to measurement of patterns of drinking (Rehm 1998), these criticisms cannot address the basic question of whether there is a demonstrated biological pathway for the alcohol effect that can explain the epidemiological effects (Rehm 2007). For the cardio-protective effect due to regular light to moderate drinking, such pathways have been demonstrated (Puddey et al. 1999; Rehm et al. 2003d). In experimental studies, regular light to moderate alcohol consumption has been shown to increase HDL cholesterol and to have a positive effect on platelet aggregation (Rehm et al. 2003d). In addition, other potential pathways with less conclusive evidence have been demonstrated (Puddey et al. 1999; Rehm et al. 2003d). This was the reason why ischaemic heart disease was included in the list of alcohol-attributable disease categories. The exact quantification of this effect is another matter and it may well be that the effect has been overestimated by the meta-analysis chosen (Corrao et al. 2000) because some of the underlying studies failed to control for some of the confounders. In any case, as alcohol has been identified as one of the major risk factors for burden of disease on a global level (Rehm et al. 2004), further research is underway, which will lead to better risk-relation estimates and, in turn, to better quantification of alcohol-attributable burden of disease.

Despite these caveats, the estimates presented are the best possible for Switzerland for today and, for lack of better estimates, should influence policy. Thus, best practices to reduce per capita consumption (Babor et al. 2003; Anderson & Baumberg 2006) should apply to Switzerland, such as taxation and availability restrictions.

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Resumen

Consumo de alcohol y la enfermedad atribuible de alcohol en Suiza, 2002

Objetivos: Este análisis estimó la carga de la enfermedad atribuible al alcohol en Suiza.

Métodos: Las distribuciones de la exposición fueron tomadas del estudio de Salud Suiza del 2002 y modificadas según la consumición de alcohol por capita. Las relaciones de riesgo fueron tomadas por meta-análisis. Los datos de mortalidad y carga de la enfermedad fueron tomados de la Organización Mundial de la Salud.

Resultados: El consumo total, la mortalidad y la carga del alcohol-atribuibles a la enfermedad en Suiza resultaron ser altos comparados con los promedios globales europeos, especialmente entre mujeres. En toda Suiza en 2002, hubieron 2.016 muertes (5.2 % de todas las muertes en hombres, 1.4 % en mujeres), 28.939 años de vida perdida (hombres: 10.5 %, mujeres: 4.9 %) y 70.256 años de vida modificada por invalidez (hombres: 12.9 %, mujeres: 4.2 %) fueron atribuibles al alcohol. Estos números son números netos que incorporan ya efectos cardio-protectores y otros efectos beneficiosos del alcohol.

Conclusiones: Las limitaciones de la aproximación usada están siendo discutidas. Además, también se están tratando las cuestiones de la causalidad y la confusión.

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